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## ATENT COOPERATION TREA

## PCT

#### NOTIFICATION OF THE RECORDING OF A CHANGE

			From t	he INTERN	NATIONAL BI	UREAU	
	PCT		То:				
NOTIFICATION OF THE RECORDING OF A CHANGE  (PCT Rule 92bis.1 and Administrative Instructions, Section 422)  Date of mailing (day/month/year) 28 August 2001 (28.08.01)				EYLES, Christopher, Thomas W.P. Thompson & Co. Celcon House 289-293 High Holborn London WC1V 7HU ROYAUME-UNI			
Applicant's or agent's file re	, , , , , , , , , , , , , , , , , , ,		L	<u> </u>			
CTE/PL62889WO				IMPO	RTANT NOTI	FICATION	
International application No PCT/GB00/00363				_	e (day/month/ye 000 (07.02.00	•	
The following indications     X the applicant	s appeared on record o		the ager	nt [	the commo	on representative	
Name and Address			<u>-</u>	State of Na	itionality	State of Residence GB	
H.B. FULLER COATI 95 Aston Church Ro Nechells Birmingham B7 7QF United Kingdom	ad			GB Telephone Facsimile I	No.	**************************************	
2. The International Bureau	hereby notifies the ap	plicant that the	e following	change has	been recorded o	concerning:	
X the person	the name	the addr	ess	the nati	onality	the residence	
Name and Address				State of Na	itionality	State of Residence	
				Telephone	No.		
		·		Facsimile I	No.		
				Teleprinter	No.		
3. Further observations, if n Deletion of applican Security Composite	it for all designate	d States exc become sole	cept US ( e applica	due to ass nt.	ignment of ri	ghts to	
4. A copy of this notification	n has been sent to:				•		
X the receiving Office			[	the des	ignated Offices	concerned	
the International Sea	arching Authority		į	X the elec	eted Offices con	cerned	
the International Pre	liminary Examining Au	uthority	[	other:			

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland

Authorized officer

Anman QIU

Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994)

Facsimile No.: (41-22) 740.14.35

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# PA. LINT COOPERATION TREAT.

	From the INTERNATIONAL BUREAU				
PCT	То:				
NOTIFICATION OF ELECTION (PCT Rule 61.2)	Assistant Commissioner for Patents United States Patent and Trademark Office Box PCT Washington, D.C.20231 ETATS-UNIS D'AMERIQUE				
Date of mailing (day/month/year) 18 October 2000 (18.10.00)	in its capacity as elected Office				
International application No. PCT/GB00/00363	Applicant's or agent's file reference CTE/PL62889WO				
International filing date (day/month/year) 07 February 2000 (07.02.00)	Priority date (day/month/year) 08 February 1999 (08.02.99)				
Applicant  DODD, Keith, Herbert et al					
1. The designated Office is hereby notified of its election made:  X in the demand filed with the International Preliminary Examining Authority on:  08 September 2000 (08.09.00)  in a notice effecting later election filed with the International Bureau on:					
2. The election X was was was not was not made before the expiration of 19 months from the priority Rule 32.2(b).	date or, where Rule 32 applies, within the time limit under				
,					
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Pascal Piriou				

Telephone No.: (41-22) 338.83.38

Facsimile No.: (41-22) 740.14.35

#### WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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8 February 1999 (08.02.99)

GB

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- (74) Agent: EYLES, Christopher, Thomas; W.P. Thompson & Co., Celcon House, 289-293 High Holborn, London WC1V 7HU (GB).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

#### **Published**

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: HEAT TRANSFER ELEMENT

(57) Abstract

The invention relates to a heat transfer element made of a polymer matrix having a fibrous material interspersed therein, said heat transfer element comprising a fluoropolymer at least on an outer surface thereof, the interspersion of the fibrous material within the polymer matrix providing rigidity to the heat transfer element, a thermally conductive material being distributed within the heat transfer element. Such a heat transfer element can be used in the manufacture of radiant panels for power generating stations or can be formed as a pipe for similar use. The heat transfer element may comprise a polymer sheet having a fibrous material distributed therein providing structural strength and a fluoropolymer at least on an outer surface of the element which protects the element from physical and chemical corrosion whilst providing anti-fouling properties and good flow characteristics to the element. A thermally conductive material is distributed within the element to provide the necessary heat transfer characteristics.

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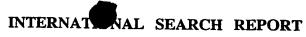
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Int. Itional Application No PCT/GB 00/00363

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C08K7/02 F28F19/04 F28F21/06 According to International Patent Classification (IPC) or to both national classification and IPC **B. FIELDS SEARCHED** Minimum documentation searched (classification system followed by classification symbols) IPC 7 C08K F28F Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) C. DOCUMENTS CONSIDERED TO BE RELEVANT Category 5 Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No. X PATENT ABSTRACTS OF JAPAN 1-3,15, vol. 012, no. 471 (M-773). 16,21,26 9 December 1988 (1988-12-09) & JP 63 194195 A (JUNKOSHA CO LTD), 11 August 1988 (1988-08-11) abstract χ EP 0 203 213 A (SIGRI GMBH) 1,2,15, 3 December 1986 (1986-12-03) 16,21, cited in the application 23,26-28 claims 1,3,6,7 -/--Χ Further documents are listed in the continuation of box C. X Patent family members are listed in annex. Special categories of cited documents: "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the "A" document defining the general state of the art which is not considered to be of particular relevance invention earlier document but published on or after the international "X" document of particular relevance; the claimed invention filing date cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the "O" document referring to an oral disclosure, use, exhibition or document is combined with one or more other such docu-ments, such combination being obvious to a person skilled other means document published prior to the international filing date but in the art. later than the priority date claimed "&" document member of the same patent family Date of the actual completion of the international search Date of mailing of the international search report 14 June 2000 21/06/2000 Name and mailing address of the ISA Authorized officer European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo ni, Fax: (+31-70) 340-3016 Russell, G

Inte...ational Application No PCT/GB 00/00363

0.10		PCT/GB 00	7/00363
C.(Continua Category	Citation of documents with indication when received the		
Jalegory /	Citation of document, with indication, where appropriate, of the relevant passages		Relevant to claim No.
X	EP 0 445 523 A (DU PONT) 11 September 1991 (1991-09-11) page 2, line 28 - line 29		1-3,15, 16,21, 26-28
	page 3, line 55 - line 56 examples 16,18 claims 1,3-5		
X	GB 1 468 410 A (KUREHA CHEMICAL IND CO LTD) 23 March 1977 (1977-03-23)		1,2,4,5, 11,12, 15,16, 19,21-23
	page 2, line 11 - line 29 claims 5,6 		15,61
X	US 5 211 220 A (SWOZIL ADOLF ET AL) 18 May 1993 (1993-05-18) claim 1		1-3,11, 15,16,19
X	US 5 036 903 A (SHOOK JAMES R) 6 August 1991 (1991-08-06)		1-3,7, 15,16, 18,19, 21,23
	figure 3 claims 1,7,8,10		
X	US 4 911 227 A (SAITO NAOHIDE ET AL) 27 March 1990 (1990-03-27)		1,2,7,8, 11,15, 16, 18-21, 27,28
	claims 1,9,12		17,20
X	US 5 409 777 A (CLEMENT KATHERINE S ET AL) 25 April 1995 (1995-04-25) example 12 claim 18		1,2,7,8, 12-14,21
Ρ,Χ	WO 99 35458 A (H B FULLER COATINGS LTD; WELTON NICHOLAS JASON (GB); DODD KEITH HE) 15 July 1999 (1999-07-15) the whole document	-	1-28



Information on patent family members

Int. .tional Application No PCT/GB 00/00363

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	atent document d in search report	i	Publication date	Pa	atent family nember(s)		Publication date
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#### CLAIMS:

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- 1. A heat transfer element comprising a polymer matrix having a fibrous material interspersed therein, said heat transfer element comprising a fluoropolymer at least on an outer surface thereof, the interspersion of the fibrous material within the polymer matrix providing rigidity to the heat transfer element, a thermally conductive material being distributed within the heat transfer element.
- 2. A heat transfer element according to claim 1, in the form of a sheet.
- 3. A heat transfer element according to claim 1, in the form of a tube.
  - 4. A heat transfer element according to any one of claims 1 to 3, in which the fibrous material comprises metal fibres.
  - 5. A heat transfer element according to claim 4, in which the metal fibres comprise iron, steel, or stainless steel fibres.
  - 6. A heat transfer element according to any one of claims 1 to 5, in which the polymer matrix further comprises particles of metal.
- 7. A heat transfer element according to any one of claims 1 to 6, in which the fibrous material comprises glass fibres.
  - 8. A heat transfer element according to claim 7, in which the glass fibres comprise chemically resistant glass fibres.
  - 9. A heat transfer element according to claim 7 or claim
- 8, in which the fibrous material comprises a mixture of glass fibres and fibres of a plastics material.
  - 10. A heat transfer element according to claim 9, in which the plastics material comprises a material selected from polypropylene and fluoropolymers.
- 30 11. A heat transfer element according to any one of claims

- 1 to 10, in which the fibrous material comprises continuous fibres.
- 12. A heat transfer element according to claim 11, in which the fibrous material comprises rovings plaited to form continuous tubes, formed into tapes, or woven into panels.
- 5 13. A heat transfer element according to claim 12, in which the rovings are precoated with a plastics material.
  - 14. A heat transfer element according to claim 12 or claim 13, in which the fibrous material comprises a continuous tube comprising loosely commingled rovings, wherein the individual rovings extend at an angle of about 10° to about 15° to the tube axis.
  - 15. A heat transfer element which comprises:

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a polymer sheet having a fibrous material interspersed therein and comprising a fluoropolymer at least on an outer surface of the sheet, the interspersion of the fibrous material within the sheet providing rigidity to the element; and

a thermally conductive material distributed within the heat transfer element.

- 16. A heat transfer element according to claim 15, wherein the fibrous material is of a thermally conductive material such that the distribution of thermally conductive material within the heat transfer element is provided, in whole or in part, by the fibrous material.
- 25 17. A heat transfer element according to claim 16, wherein the fibrous material is of stainless steel.
  - 18. A heat transfer element according to claim 16, wherein the fibrous material is fibre glass.
- 19. A heat transfer element according to any one of claims10. 10. 10. Wherein an intermediate layer of a plastics material

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is provided underneath the outer fluoropolymer surface of the element.

- 20. A heat transfer element according to claim 19, wherein the plastics material comprises an acrylic polymer.
- 21. A heat transfer element according to any one of claims 1 to 20, wherein the thermally conductive material comprises a particulate or filamented material.
- 22. A heat transfer element according to claim 21, wherein the particulate or filamented material is a metal.
- 23. A heat transfer element according to any one of claims 1 to 22, wherein the fluoropolymer comprises PVDF.
- 24. A heat transfer element according to any one of claims 1 to 23, wherein the fluoropolymer is mixed with another thermoplastic polymer.
- 25. A heat transfer element according to claim 24, wherein the other thermoplastic polymer is an acrylic polymer.
- 26. A tubular heat transfer element according to any one of claims 1 to 25, formed by extruding a mixture of fluoropolymer, fibrous material and, where necessary, particulate or filamented thermally conductive material.
- 27. A process for the production of a heat transfer element according to any one of claims 1 to 25 comprising providing a fibrous base portion, and forming by compression moulding or lamination over the surface of the base portion a coating of a fluoropolymer.
- 28. A process according to claim 27, further including the step of distributing a thermally conductive material within the element.

## **TENT COOPERATION TR**

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# **PCT**

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's	or age	ent's file reference	T					
CTE/PL62889WO			FOR FURTHER AC	CTION		ation of Transmittal of International Examination Report (Form PCT/IPEA/416)		
Internation	al appl	ication No.	International filing date (c	day/month	'year)	Priority date (day/month/year)		
PCT/GB	00/00	363	07/02/2000			08/02/1999		
Internation C08K7/0		ent Classification (IPC) or nat	tional classification and IPC					
Applicant H.B. FUL	LER	COATINGS LTD. et al	l					
1. This i	interna s trans	ational preliminary exami smitted to the applicant a	nation report has been pecording to Article 36.	prepared	by this Inte	rnational Preliminary Examining Authority		
2. This	REPO	RT consists of a total of	5 sheets, including this	cover sh	eet.			
b (:	This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  These annexes consist of a total of 3 sheets.							
3. This r	eport	contains indications relat	ting to the following item	ns:				
I	$\boxtimes$	Basis of the report						
H		Priority						
Ш		Non-establishment of op-	pinion with regard to nov	elty, inve	ntive step a	and industrial applicability		
IV		Lack of unity of invention	n					
V	⊠	Reasoned statement un citations and explanation	der Article 35(2) with re ns suporting such stater	gard to ne ment	ovelty, inver	ntive step or industrial applicability;		
VI	_	Certain documents cited	d					
VII	_	Certain defects in the int	• •					
VIII		Certain observations on	the international applica	ation 				
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# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00363

I. Basis of	f the report
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1.	the and	With regard to the <b>elements</b> of the international application (Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)): <b>Description, pages:</b>								
	1-1	4	as originally file	ed						
	Cla	aims, No.:								
	1-1	8,20-22 <sup>*</sup>	as received on		12/03/2001	with letter of	07/03/2001			
2.	lan	h regard to the lang guage in which the i ese elements were a	international app	olication was file	ed, unless oth	erwise indicated ur				
		the language of pu	iblication of the	international ap	plication (und	er Rule 48.3(b)).	n (under Rule 23.1(b)). y examination (under Rule			
3.	Witi	55.2 and/or 55.3). h regard to any <b>nuc</b> rnational preliminar	eleotide and/or a y examination w	amino acid se vas carried out	<b>quence</b> disclo on the basis o	sed in the internati f the sequence listi	onal application, the ng:			
		contained in the in	ternational appli	cation in writter	n form.		•			
		filed together with	the international	l application in o	computer read	able form.				
		furnished subsequ	ently to this Autl	hority in written	form.					
		furnished subsequ	ently to this Autl	hority in compu	ter readable fo	orm.				
		The statement that the international ap				e listing does not g	o beyond the disclosure in			
		The statement that listing has been full		recorded in co	mputer readal	ole form is identica	to the written sequence			
4.	The	amendments have	resulted in the	cancellation of:						
		the description,	pages:							
	×	the claims,	Nos.:	19,23-28						
		the drawings,	sheets:							
5.		This report has bee	en established a eyond the disclo	s if (some of) the sure as filed (F	ne amendmen Rule 70.2(c)):	ts had not been ma	ade, since they have been			

## **EXAMINATION REPORT - SEPARATE SHEET**

## Paragraph V:

1. Relevant documents:

D6 US-A-5 036 903

D7 US-A-4 911 227

D8 US-A-5 409 777

2. D6 relates to a heat recovery method and heat-exchanger having corrosion resistant tubes and tube sheets. One aspect is a corrosion-protection coating system for the side apertured tube sheets through which the graphite tubes of the heat-exchanger penetrate. The coating system comprises an inner silicon-carbide impregnated expoxidized novolak coating adherently affixed to the tube sheet and over which is a fiber-reinforced fluoroplastic layer (col 2, I 17-23; claim 1). The fiber-reinforcement comprises glass fiber, and the fluoroplastic comprises an elastomer derived from a combination of vinylidene and hexafluoropropylene (col 4, I 29-60; claims 8, 10).

D7 discloses a heat-exchange element composed of a sheet material which comprises glass fiber, an inorganic filler, and a binder (claim 1). This sheet may be coated with a coating material comprising an organic binder such as an acrylic resin (col 4, I 34-37).

The element further comprises a fluorine coating layer formed on the surface thereof (Example 4; claim 9). The heat-exchange may be a one sheet material or a honeycomb structure formed by laminating a plurality of sheets (claim 12).

D8 deals with a laminate useful in a heat exchanger having at least two layers, said laminate comprising at least one layer of a polymer having more than one perfluorocyclobutane groups to be coated on a substrate, and at least one reinforcing or filling layer which may contain glass fiber materials (claims 1, 5, 7, 18). The fluoropolymer forms a hydrostatically stable, chemically resistant coating on the substrate.

The perfluorocyclobutane containing polymer also contains other materials including metal particles (col 16, I 9-24). They are useful in composites wherein the polymer surrounds, thus forms layers around such materials as fiber glass, particularly fiber glass mats (woven or non-woven) (col 16, I 30-54). Examples 12 and 13 describe the preparation of fluoropolymer coated woven glass fiber mat

(electrical glass).

Therefore, the subject-matter of claims 1-3, 6, 7, 10, 11, 14-16, 18, and 21 do not fulfil the requirements of novelty and inventiveness laid out in Articles 33(2) and 33(3) PCT.

3. The technical problem of the present application, namely to provide a heat transfer element having improved heat transfer and mechanical properties and resistance to corrosion, has already been solved in the prior art using heat transfer elements comprising fluoropolymers and glass fibers to provide improved heat-transfer properties and resistance to chemical corrosion. Hence, the inventive concept underlying the application is known and obvious from the teachings of the prior art.

Dependent claims 4, 8, 9, 12, 13, 17, 20, and 22 merely represent standard modifications in the technical field which have not been shown in the application to provide any surprising or non-obvious technical advantage.

Hence, an inventive merit under Article 33(3) PCT cannot be recognized.

### Paragraph VII:

The claims have been wrongly numbered, i.e., namley from 1-18 and 20-22, claim 19 having been omitted.



## INTERNATIONAL PRELIMINARY **EXAMINATION REPORT**

International application No. PCT/GB00/00363

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

- 6. Additional observations, if necessary:
- V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- 1. Statement

Novelty (N)

Yes:

Claims 4,8,9,12,13,17,20,22

No:

Claims 1-3,6,7,10,11,14-16,18,21

Inventive step (IS)

Claims

Yes:

No: Claims 1-22

Industrial applicability (IA)

Yes:

Claims 1-22

No: Claims

2. Citations and explanations see separate sheet

#### VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted: se separate sheet

## **ENT COOPERATION TREATY**

# **PCT**

## **INTERNATIONAL SEARCH REPORT**

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference		f Transmittal of International Search Report						
CTE/PL62889WO	ACTION (Form PC1/ISA/2	20) as well as, where applicable, item 5 below.						
International application No.	International filing date (day/month/year)	(Earliest) Priority Date (day/month/year)						
PCT/GB 00/00363	07/02/2000	08/02/1999						
Applicant								
U.B. FINAED COATANGE LTD.	.4 .1							
H.B. FULLER COATINGS LTD. et al.								
This later sties of Court Board has been	a second but his lateractional Constitute Author	orth, and in transmitted to the conflictor						
according to Article 18. A copy is being tra	n prepared by this International Searching Auth Insmitted to the International Bureau.	only and is transmitted to the applicant						
Third to 100 100 100 100 100 100 100 100 100 10	3							
This International Search Report consists  IX It is also accompanied by	of a total of3 sheets. a copy of each prior art document cited in this	report.						
Basis of the report     With regard to the lenguage the	international search was carried out on the bas	is of the international application in the						
	ess otherwise indicated under this item.	is of the international application in the						
the international search w Authority (Rule 23.1(b)).	as carried out on the basis of a translation of th	ne international application furnished to this						
b. With regard to any <b>nucleotide an</b> was carried out on the basis of the		ternational application, the international search						
1 —	nal application in written form.							
filed together with the inte	rnational application in computer readable form	n.						
	this Authority in written form.							
	this Authority in computer readble form.							
international application as	sequently furnished written sequence listing do s filed has been furnished.	pes not go beyond the disclosure in the						
the statement that the info furnished	rmation recorded in computer readable form is	identical to the written sequence listing has been						
2. Certain claims were four	nd unsearchable (See Box I).							
3. Unity of Invention is laci	dng (see Box II).							
A Milah as a said to the Albert								
4. With regard to the <b>title</b> ,  The text is approved as su	bmitted by the applicant							
	ned by this Authority to read as follows:							
LITE TEXT HAS DEEN ESTABLISHED BY THIS AUTHORBY TO TEAU AS TOHOWS.								
5. With regard to the abstract,								
the text is approved as submitted by the applicant.								
	ned, according to Rule 38.2(b), by this Authorit date of mailing of this international search rep							
6. The figure of the <b>drawings</b> to be publi								
as suggested by the applic	cant.	X None of the figures.						
because the applicant faile	ed to suggest a figure.	<del></del>						
because this figure better	characterizes the invention.	·						